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Router Forensic Analysis against Distributed Denial of Service (DDoS) Attacks

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ABSTRACT

A Distributed Denial of Service (DDoS) attack is a multi-computer attack targeting a single device to increase the amount of network traffic and paralyze the target. The number of DDoS attacks continues to increase and has a more sophisticated variety of attacks so that an effective technique is needed to find out information related to these attacks. This research uses the Network Forensic Generic Process Model which has 8 stages, namely preparation, detection, collection, preservation, examination, analysis, investigation, presentation, and using the live forensic method in the data acquisition process. This research uses the help of tools including Snort, Wireshark, Elasticsearch, Kibana, and Logstash. This research succeeded in obtaining digital evidence containing information related to the attack, namely, there were 5 IP addresses for the attacker, attacks that occurred on port 80 TCP with one target IP address, attacker ID, the total number of attacks totaling 126,286 attack packets and the time of the attack. This research succeeded in obtaining data and information derived from the evidence obtained, from these results it can make it easier to strengthen security at existing points of vulnerability, or as digital evidence in court.

Keywords

DDoS Attacks, Network Forensic Generic Process Model, Live Forensic.

1. INTRODUCTION

Computer technology has been utilized in the lot fields and makes it easy for its users to carry out activities online. However, the convenience and sophistication of this technology does not always have a positive impact but also has a negative impact, one of which is the security problem against Distributed Denial of Service Attack (DDoS), namely an attack technique by flooding the system with a large number of service requests until the system is unable to respond. [1]. Data from the Imperva research lab revealed that DDOS attacks that occurred in the world increased to 680 Gbps in 2018. [2]. Network forensics is a part of digital forensics that deals with investigation events and activities related to digital networks, which include monitoring and capturing network traffic and related data from devices connected to the network to gather evidence in a manner acceptable to a court of law [3]. Live forensics is the activity of collecting evidence from the system running in real-time on memory or other storage media so that it is not lost or changed when the system is shut down. [4]. Wireshark is a tool that is used to capture and analyze packets on the network, but it is also used to analyze the protocol used [5]. Intrusion Detection System (IDS) works by monitoring packets in the network and making comparisons with the existing signature database in the IDS system or the attributes of the attack never known. [6]. The investigation process is carried out to obtain data that can later be used as evidence so that the

process is successful, a stage in the data collection process is needed, in this research, the stages of the investigation process are carried out using the Network Forensic Generic Process Model, the process has several stages of the investigation, namely preparation, detection, incident response, collection, preservation, examination, analysis, investigation, and presentation. [7].

1.1 Literature Review

1.1.1 Previous Studies

Ram Charan Baishya, Nazrul Hoque, & Dhruba Kumar Bhattacharyya (2017) This study has shown that in this case, the source with the attack packet rate that exceeds the average value is significant and thus can detect the change. [8]

Abhishash B. Pawade, Prof. Santosh T. Waghmode (2017) has researched to detect DDoS attacks by conducting Multivariate Correlation Analysis (MCA) and ANN analysis on the KDD Cup 99 dataset. This analysis shows good performance and resilience of MCA and shows that the system very well outperforms the other two previously developed approaches in terms of accuracy detection attack. [9].

Rajput, Reena & Agrawal (2017) in their research entitled "Denial of Service Attack Detection Using Random Forest Classifier with Information Gain" found that a randomized approach also had a major influence on the accuracy of the overall analysis [10].

Mazdadi, Muhammad Itqon & Imam Riadi (2017) in their research entitled "Forensic Analysis on RouterOS Using the Live Forensics Method" show that this study found information related to attack information that can be used to perform analysis to disclose attack activities that occur on the Router. [11].

Ali et al., (2016) in their research entitled "A Neural Network Model for Detecting DDoS Attacks Using Darknet Traffic Features" shows that the technique can detect attacks very well compared to the detection system it uses classifier attack online conventional. [12].

1.1.2 Network Forensics

Network Forensics is an activity to capture, record, and analyze events that occur on the network to find the source of security attacks or other incidents of problems [13].

1.1.3 Live Forensics

Live Forensics is a method used to acquire data when the system is running. [14]

1.1.4 Network Attack Classification

Network Attack Classification is a process for grouping network attacks into certain subgroups to determine the same type of attack in the future. The purpose of this grouping is to help us find out more details about the characteristics of the

type of attack. [15]

1.1.5 Distributed Denial of Service (DDoS)

DDoS attacks occur because the number of packets sent to the target server is very large, exceeding the capabilities of the server which makes the system slow or even crash. [16].

1.1.6 Router

The router is a hardware used in a computer network and has a function to connect and aim to forward data packets between two or more different networks so that they can communicate with each other. [17].

1.1.7 Intrusion Detection System (IDS)

Intrusion Detection System (IDS) is a method used to detect suspicious activity on a system or network. [18]

1.1.8 Snort

Snort is a network security system that has a function to detect intrusions on the network in the form of attacks, intrusions, reconnaissance, and other threats, besides that it can be used for preventive measures. [19]. Snort also has components that work together in detection, the components in snort are shown in Figure 1.

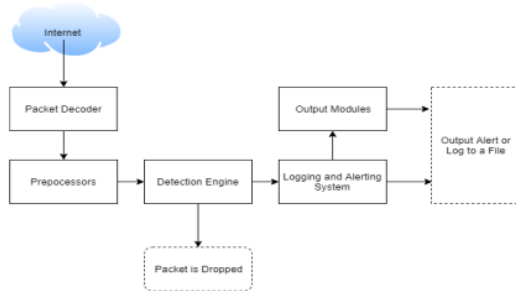


Figure 1. The Snort component

The components in the snort system are related to each other so that the system can function properly against suspicious network traffic, and then create outputs that can be analyzed later. [20]

1.1.9 Elasticsearch

Elasticsearch is a machine that is used as a tool to search and analyze all types of data. The process that occurs is the processing of raw data is carried out in several stages before it ends at the Indexing stage [21].

1.1.10 Kibana

Kibana is an additional system in the Kibana engine that is used for data visualization and management of indexed content in the Elasticsearch engine. Kibana has a dashboard feature that functions as a data collector that has been visualized on the dashboard page. [22]

1.1.11 Logstash

Logstash is a system that functions to collect and process data before it is sent to the Elasticsearch engine. All data that has been collected will then be sent to Elasticsearch for the indexing stage. [23]

2. METHODOLOGY

2.1 Research Scenario

The forensic investigator analyzes the attack. The case study used in this research is an attack that occurs on a PC router, where the PC router is connected to a local network that

contains several clients and servers, the attack is carried out so that the client cannot access the resource because it has been fulfilled by the attack traffic. The research scenario is used to show the steps involved in carrying out the live forensic method in DDoS attacks. The design of DDOS attack simulations on Router devices uses the Pentmenu, to analyze attacks that occur on the Router using the Wireshark, Kibana, Logstash, Elasticsearch, and Snort. DDoS attack scenarios that occur on Router devices are as shown in Figure 2.

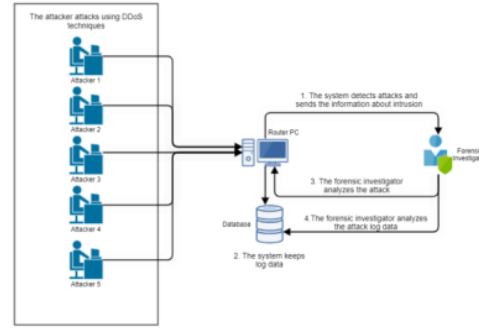


Figure 2. Simulation of a Distributed Denial of Service (DDoS) attack

In Figure 2 above, it can be seen that DDoS attacks are carried out by utilizing multiple attacks through several devices. Because a network engineer detects an anomaly on a request that occurs on the server then performs a live forensic stage to find out the source of the attack and the type of attack that occurred, which is then carried out in the analysis stage of the attack that occurred.

2.2 Research Stages

The process for conducting forensic analysis in this study is based on Network Forensic Generic Process Model which is an analysis model used to perform the detection, data acquisition, and analysis stages that occur in computer networks. The research stages are as shown in Figure 3.

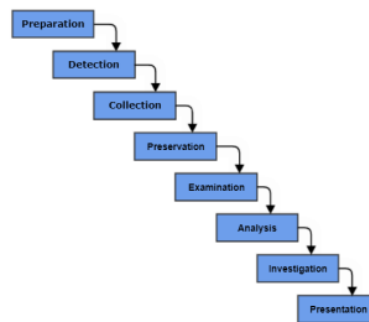


Figure 3. Network Forensic Generic Process Model

Figure 3 shows that to research a DDoS attack, the first stage carried out is to make preparations by configuring the devices and systems used, then testing the system that has been created to detect attacks, then the attack data is collected and carried out in stages, analysis of the attack log which is then made into reports.

2.2.1 Preparation

The first step in this research is to design a network monitoring

system and attack detection.

2.2.2 Detection

This stage is the stage where the system is carried out in the testing phase with Distributed attacks Denial of Service (DDoS) performed by multiple devices.

2.2.3 Collection

The Collection stage is the stage where the detection system installed on the device detects any unusual activity occurring on the network. The flow of the log data collection process is shown in Figure 4.



Figure 4. Log Data Collection Process Flow

Figure 4 shows that the system starts collecting data automatically and stores it for the next forensic stage.

2.2.4 Preservation

After the log data has been collected by the monitoring system, the next stage is the preservation stage, where the authenticity of the data that has been obtained must be maintained so that there are no changes in data that result in inconsistencies in data validity. The data maintenance stage is as shown in Figure 5.



Figure 5. Data Maintenance Stage

Figure 5 shows how the flow for maintaining log files by backing up to other storage media, in this flow the hashing stage is carried out 2 times which functions to validate data if there is a data change then the hashing results also provide a different value.

2.2.5 Examination

At this stage, the data that has been collected and obtained is carried out at the stage of checking whether the data is related to events that have occurred and have data that can be used in the analysis stage.

2.2.6 Analysis

The analysis stage is the stage where the data has been obtained processed to be easy information understood so that it can be useful for making decisions.

2.2.7 Investigation

The investigation stage is the stage for compiling data and identifying data findings, such as which IP carried out the attack, where the attack occurred, when the attack occurred, how it happened, and why the attack occurred.

2.2.8 Presentation

The Presentation stage is carried out to show the results of the investigation in a language that is easy to understand so that it is easier to capture information.

3. RESULT AND DISCUSSION

The implementation of this research study requires software and hardware as research material for the smooth running of the

research process. The tools and materials needed in this study are as shown in table 1.

Table 1. Tools and Materials

No	Device Name	Information
1	Laptop 1	Core i7, 16Gb RAM, 1Tb HDD
2	PC router	Core i3, HDD 500GB, 8GB RAM
3	PC Attacker 1	Core i3, 8Gb RAM, 500Gb
3	PC Attacker 2	Core i3, 8Gb RAM, 500Gb
4	PC Attacker 3	Core i3, 8Gb RAM, 500Gb
5	PC Attacker 4	Core i3, 8Gb RAM, 500Gb
6	Windows 10	The operating system used to conduct research
7	Kali Linux	The operating system used for the attack process
8	Ubuntu 16.04	The operating system used for the router PC
9	Snort	The system used for network anomaly detection and forensic stage
10	Elasticsearch	The system used for the log data indexing stage
11	Logstash	The system is used for network monitoring and anomaly detection
12	Kibana	The system used for log data visualization
13	Pentmenu	Tools used as a tool to attack
14	Wireshark	The system used for network monitoring and packet analysis in the network at the forensic stage

3.1 Preparation

3.1.1 Router Configuration

Router configuration is done to connect between different networks. The configuration is done by giving an IP address to each different interface and later it is used to connect the connection. The router configuration display is as shown in Figure 6.

```

$ interfaces($?) file used by (fup($?) and (fdow($?)
auto lo
iface lo inet loopback

The internal interface on meta
auto enp0s8
iface enp0s8 inet static
address 192.168.1.1/24
netmask 255.255.255.0
network 192.168.1.0
broadcast 192.168.1.255

The internal interface on netb
auto enp0s9
iface enp0s9 inet static
address 192.168.2.2
netmask 255.255.255.0
network 192.168.2.0
broadcast 192.168.2.225
  
```

Figure 6.Configuration of the Network Interface Card (NIC)

Figure 6 shows how to configure the Network Interface Card (NIC). The addition of IP addresses is done on the enp0s8 interface which is connected to the local network and enp0s9 which is connected to the server.

3.1.1.1 Snort System Implementation

The Snort system is used to detect anomalies in the network. The status that the snort system has been running is as shown in Figure 7.

Figure 7: Status of Active Snort System

3.1.1.2 Elasticsearch System Implementation

```
root@router:/tmp$ sudo systemctl status elasticsearch.service
● elasticsearch.service - Elasticsearch
   Loaded: loaded (/usr/lib/systemd/system/elasticsearch.service; enabled; vendor preset: enabled)
   Active: active (running) since Thu 2020-07-23 11:25:07 WIB; 27s ago
     Docs: https://www.elastic.co
 Main PID: 6536 (java)
    Tasks: 58 (limit: 3629)
   CGroup: /system.slice/elasticsearch.service
           └─ 6536 /usr/share/elasticsearch/jdk/bin/java -Des.networkaddress.cache.ttl=60 /usr/share/elasticsearch/modules/x-pack-core/platform/Linux_x86_64

Jul 23 11:23:57 router system[1]: Starting Elasticsearch...
Jul 23 11:23:57 router system[1]: Started Elasticsearch.
Jul 23 11:23:57 router system[1]: Started Elasticsearch.
Jul 23 11:23:57 router system[1]: Started Elasticsearch.
Jul 23 11:23:57 router system[1]: Started Elasticsearch.
Jul 23 11:23:57 router system[1]: Started Elasticsearch.
```

Figure 8 shows that the Elasticsearch system has been successfully running in the system after the installation and configuration stages were previously carried out which can later be used to do the indexing stage of log data originating from Logstash.

```
root@router:/home/ray# sudo systemctl status kibana.service
● kibana.service - kibana
   Loaded: loaded (/etc/systemd/system/kibana.service; enabled; vendor preset:
   Active: active (running) since Mon 2020-08-10 20:27:17 WIB; 1 day 21h ago
 Main PID: 664 (node)
   Tasks: 11 (limit: 4915)
   CGroup: /system.slice/kibana.service
           └─664 /usr/share/kibana/bin/.node/bin/node /usr/share/kibana/bin/.
```

3.1.1.4 Logstash System Implementation

```
root@router:/home/rayw# sudo systemctl status logstash.service
● logstash.service - logstash
   Loaded: loaded (/etc/systemd/system/logstash.service; enabled; vendor preset: enabled)
   Active: active (running) since Wed 2020-08-12 21:47:40 WIB; 28s ago
     Main PID: 2682 (java)
       Tasks: 3 (limit: 4915)
     CGroup: /systemd/system/logstash.service
             └─2682 /usr/bin/java -Xms1g -Xmx1g -XX:+UseConcMarkSweepGC -XX:CMS...
```

3.1.1.5 Wireshark System Implementation

The screenshot shows the Wireshark network protocol analyzer interface. The top menu bar includes File, Edit, Capture, Analyze, Packets, Settings, Windows, Tools, and Help. Below the menu is a toolbar with icons for various functions like opening files, saving, zooming, and filtering. The main pane displays a list of captured packets, with packet 10 selected. The packet details pane on the right shows the structure of the selected packet:

- Ethernet II**: Src=Realtek-80:00:00:0E:9F:5B, Dst=Realtek-80:00:00:0E:9F:5B
- TCP**: Src Port=64738, Dst Port=80, Seq=3252222222, Win=0, Len=0. The "Reset flag set" field is highlighted.
- Hypertext Transfer Protocol**: GET / HTTP/1.1

The packet list on the left shows several other packets, mostly from the same source IP (192.168.1.102) to destination IP (192.168.1.1), indicating a series of connection attempts or resets.

The first test is carried out to test the attack detection system that is on Snort, this is done to find out whether the configuration carried out can detect anomalies that occur in the network. Display attack detection with a snort as shown in Figure 12.

Kibana is a system used to visualize network traffic logs in collaboration with Logstash and Elasticsearch. Figure 13 is a display that the Kibana system can detect that there is an increase in traffic levels in the network.



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the network as Figure 14.

No.	Time	Source	Destination	Protocol	Length	Info
2238	200-83082744	192.168.1.14	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2239	200-83082744	192.168.1.13	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2240	200-83082744	192.168.1.12	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2241	200-83082744	192.168.1.11	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2242	200-83082744	192.168.1.10	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2243	200-83082744	192.168.1.9	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2244	200-83082744	192.168.1.8	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2245	200-83082744	192.168.1.7	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2246	200-83082744	192.168.1.6	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2247	200-83082744	192.168.1.5	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2248	200-83082744	192.168.1.4	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2249	200-83082744	192.168.1.3	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2250	200-83082744	192.168.1.2	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2251	200-83082744	192.168.1.1	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360

Figure 14. Display Detection with Wireshark

Figure 14 shows that the Wireshark system is showing existing network traffic, to be able to find out information related to attacks.

3.1.3 Collection

The Collection stage is the stage where data that has been received by various systems and detection sensors are collected for later analysis of the anomalous activity that occurs. The system automatically collects data and saves it into a file.

3.1.3.1 Collection With Snort

After the activity is detected by the system, the Snort system will store the activities that occur by storing them in a log. The snort log display is as shown in Figure 15.

```
FW----- 1 root root 134217678 Aug 14 23:15 snort.log.1597421103
FW----- 1 root root 134217706 Aug 14 23:28 snort.log.1597421722
FW----- 1 root root 74375466 Aug 14 23:38 snort.log.1597422526
FW----- 1 root root 29803226 Aug 15 22:11 snort.log.1597501743
FW----- 1 root root 110783 Aug 15 22:36 snort.log.1597505754
```

Figure 15. Display of the Snort Log File

Figure 15 shows that the Snort system has successfully saved log data into several files that will be used to perform analysis.

3.1.3.2 Collection With Wireshark

After the activity has been detected, the Wireshark system will immediately display information on every activity that occurs in the network. The display of network traffic data on the Wireshark is as shown in Figure 16.

No.	Time	Source	Destination	Protocol	Length	Info
2238	200-83082744	192.168.1.14	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2239	200-83082744	192.168.1.13	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2240	200-83082744	192.168.1.12	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2241	200-83082744	192.168.1.11	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2242	200-83082744	192.168.1.10	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2243	200-83082744	192.168.1.9	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2244	200-83082744	192.168.1.8	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2245	200-83082744	192.168.1.7	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2246	200-83082744	192.168.1.6	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2247	200-83082744	192.168.1.5	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2248	200-83082744	192.168.1.4	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2249	200-83082744	192.168.1.3	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2250	200-83082744	192.168.1.2	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360
2251	200-83082744	192.168.1.1	192.168.1.1	SSH	60	Fragmented SP protocol (protocol:SSH, offset:0-60) Reassembled in 42360

Figure 16. Display Log Files From Wireshark

Figure 16 shows that the Wireshark system has succeeded in storing log data which will be used for analysis. An example of a file reading the network traffic on the device is shown in Figure 17.

```
ray@router:~$ cd Documents/
ray@router:~/Documents$ ls
Network_log_1.csv
ray@router:~/Documents$ ls -l
total 445384
-rw-r--r-- 1 root root 456069120 Aug 16 01:17 Network_log_1.csv
```

Figure 17. Display Log Files From Wireshark

Figure 17 shows that the results of the log storage from Wireshark have been successfully saved, and are stored in the form of a CSV file. Henceforth, it is used for back-up media in case of errors in the analysis of other files.

3.1.3.3 Collection With Kibana

Every activity that occurs in network traffic can be read directly by the Logstash system and then the indexing stage is carried

out and then sent to Kibana to then visualize the activities that occur in the network. The display of how the Kibana system is as shown in Figure 18.

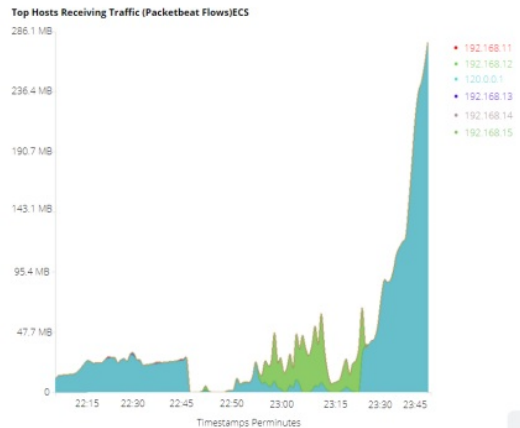


Figure 18. Display Log Files From Kibana

Figure 18 shows that Kibana has successfully displayed unusual network traffic data that comes from data obtained by logstash and elasticsearch.

3.1.4 Preservation

At this stage the data that has been collected and stored must be carried out in the hashing stage or giving identity to the data, then the back-up stage is carried out to the storage media so that the data remains safe in case of errors in data analysis. Stages this is done on any log data stored from Wireshark, snort, and logstash.

3.1.5 Examination

At this stage, the data that has been collected and obtained is carried out at the stage of checking whether the data is related to the incident that occurred. At this stage, check every log data that has been stored by each detection system.

3.1.6 Analysis

3.1.6.1 Analysis with Kibana

The Kibana system is a system that functions to visualize incoming logs to get analyzed. To know the graph of the increase in the Kibana system as shown in Figure 19.

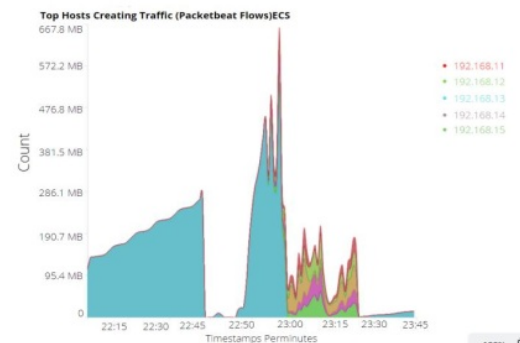


Figure 19. Display of Network Traffic

Figure 19 shows that there are IP addresses from outside which increase network traffic significantly. The IP address list is as in table 2.

Table 2. List Attacker of IP Address

No.	IP Address
1	192.168.1.11
2	192.168.1.12
3	192.168.1.13
4	192.168.1.14
5	192.168.1.15

Table 2 shows that the system has successfully stored information related to the IP address used by the attacker in carrying out the attack.

3.1.6.2 Analysis with Log Snort

The snort log analysis stage is carried out by opening the snort log file that has been previously saved. The results of the Snort log are as shown in Figure 20.

```

*****
WARNING: No preprocessors configured for policy 0.
08/14-23:28:37.247893 08:00:27:02:04:40 -> 08:00:27:06:46:83 type:0x00 len:0x3C
192.168.1.14 -> 192.168.1.1 ICMP TTL:64 TOS:0x0 ID:55141 Iplen:20 DgmLen:28
Type:8 Code:0 ID:51975 Seq:38610 ECHO
*****
WARNING: No preprocessors configured for policy 0.
08/14-23:28:37.247896 08:00:27:02:04:40 -> 08:00:27:06:46:83 type:0x00 len:0x3C
192.168.1.13 -> 192.168.1.1 ICMP TTL:64 TOS:0x0 ID:7334 Iplen:20 DgmLen:28
Type:8 Code:0 ID:47623 Seq:24828 ECHO
*****

```

Figure 20. Display of Log Snort Analysis

Figure 20 shows that after analysis several IP addresses had high traffic levels. The list of IP addresses is shown in table 3.

Table 3. List Attacker of IP Address

No.	IP Address	ID	Port	Seq
1	192.168.1.11	29534	80	31670
2	192.168.1.12	27945	80	22850
3	192.168.1.13	12357	80	19279
4	192.168.1.14	12785	80	997
5	192.168.1.15	28173	80	54987

Table 3 shows that the system has succeeded in storing information related to the attack that occurred and can be used for the analysis phase.

3.1.6.3 Analysis with Log Wireshark

The analysis phase of the Wireshark log is carried out to find information related to the attack. The analysis phase of the Wireshark log is as shown in Figure 21.

```

462761 462760 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46032)
462762 462761 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46030)
462763 462762 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46032)
462764 462763 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46030)
462765 462764 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46032)
462766 462765 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46030)
462767 462766 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46032)
462768 462767 64.48430048 192.168.1.13 192.168.1.1 IPv4 60 Fragmented IP packet (proto=TCP, d=2038, O=0x0) (Reassembled in 46030)

```

Figure 21. Wireshark Log Analysis

Figure 21 shows that there is high traffic on devices carried by several IP addresses. The results found in the Wireshark log analysis are that the attack occurred on IPv4 with the TCP protocol with a length of 60 bytes.

3.1.7 Investigation

The investigation stage is the stage for compiling data and identifying data findings. Result Investigation is as in table 4.

Table 4. IP Address Attacker List

No.	Timestamp	IP Address	ID	Port	Seq
1	08 / 14-23: 28: 37	192.168.1.11	29534	80	31670
2	08 / 14-23: 28: 37	192.168.1.12	27945	80	22850
3	08 / 14-23: 28: 37	192.168.1.13	12357	80	19279
4	08 / 14-23: 28: 37	192.168.1.14	12785	80	997
5	08 / 14-23: 28: 37	192.168.1.15	28173	80	54987

Table 4 shows that the system has succeeded in storing information related to attacks that occurred and can be used for increased security or as data in court.

3.1.8 Presentation

The Presentation stage is carried out to show the results of the investigation in a language that is easy to understand. The level of attacks carried out is different in the number of each IP address as shown in Figure 22.



Figure 22. Graph of Attack Levels Based on IP Address

Figure 22 shows a graph showing that each IP Address has intensity different attacks and make service disrupted.

3.1.9 Result

The result of live forensics on the Router can seen in table 5.

Information	Timestamp	IP Address	ID	Port	Seq
Kibana	✓	✓			
Snort	✓	✓	✓	✓	✓
Wireshark	✓	✓		✓	

Based on tabel 5, the results of the study almost get all the information about DDOS attacks.

4. CONCLUSION

Based on the results of the research carried out, it can be concluded that the steps taken to analyze Log data carried out using the Wireshark, Snort, Kibana, Elasticsearch, and Logstash tools can effectively detect and store Log data, then the Live Forensic process by utilizing the Network Forensic Generic Process Model. which is done to retrieve data can be effective and safe in carrying out the forensic process by producing some data and graphics, and the results of the analysis in this study produce information, including who is the attacker's IP address, where is the destination port of the attack, when is the time the occurrence attacks, where the destination IP Address is carried out by the attack and how large the sequence of attacks is received.

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